Bonneville Power Administration
Fish and Wildlife Program FY99 Proposal

Section 1. General administrative information

Umatilla and Walla Walla Basin Natural Production M&E Project

Bonneville project number, if an ongoing project 9000501

Business name of agency, institution or organization requesting funding
Confederated Tribes of the Umatilla Indian Reservation

Business acronym (if appropriate) CTUIR

Proposal contact person or principal investigator:

Name	Gary James
Mailing Address	P.O. Box 638
City, ST Zip	Pendleton, Oregon 97801
Phone	541 276-4109
Fax	541 276-4348
Email address	jaburke@uninet.com

Subcontractors.

Organization	Mailing Address	City, ST Zip	Contact Name
CRITFC	729 N.E. Oregon Suite 200	Portland, Oregon 97232	Andre Talbot

NPPC Program Measure Number(s) which this project addresses.
703 (f)(1)(b)

NMFS Biological Opinion Number(s) which this project addresses.
NA

Other planning document references.

CRITFIC, 1995. Wy-Kan-Ush-Mi Wa-Kish-Wit, Volume I , 5B-13

CRITFIC, 1995. Wy-Kan-Ush-Mi Wa-Kish-Wit, Volume II, Pages 42-45 and 52-54

CTUIR, 1989. Umatilla Hatchery Master Plan. Pages 60-87

CTUIR, 1993. Northeast Oregon Hatchery Project, Umatilla Hatchery Supplemenation Master Plan. Pages 19-21

CTUIR and ODFW, 1990. Walla Walla River Subbansin Salmon and Steelhead Production Plan. Pages 66-71.

ODFW, 1986, A Comprehensive Plan for Rehabilitation of Anadromous Fish Stocks in the Umatilla River Basin.

ODFW, 1997. Umatilla Basin Annual Operating Plan, Section VIII

CTUIR and ODFW, 1990. Walla Walla River Subbasin Salmon and Steelhead Production Plan.

Subbasin.
Umatilla, Walla Walla

Short description.
Monitor and evaluate natural spawning, rearing, migration, survival, life histories, age and growth characteristsics, and gentic characteristics of adult salmon and steelhead and their natural progeny in the Umatilla and Walla Walla River Basins.

Section 2. Key words

Mark	Programmatic Categories	Mark	Activities	Mark	Project Types
X	Anadromous fish		Construction		Watershed
	Resident fish		O & M	X	Biodiversity/genetics
	Wildlife		Production	X	Population dynamics
	Oceans/estuaries		Research		Ecosystems
	Climate	X	Monitoring/eval.		Flow/survival
	Other		Resource mgmt		Fish disease
			Planning/admin.	X	Supplementation
			Enforcement		Wildlife habitat enhancement/restoration
			Acquisitions		

Other keywords.
Life histories

Section 3. Relationships to other Bonneville projects

Project #	Project title/description	Nature of relationship
NA		

Section 4. Objectives, tasks and schedules

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Monitor spawning activities of hatchery and natural spring and fall chinook and coho salmon, and summer steelhead in the Umatilla River Basin. Monitor steelhead spawning in the Walla Walla River Basin.	a	Document the number and locations of redds and examine carcasses in index areas and in other areas throughout both basins as conditions allow.
		b	Estimate survival to spawning and total egg deposition by species, reach and basin.
		c	Collect and record length, sex, pre/post spawn mortality data, coded wire tags, marks, PIT tags, fin clips, kidney samples and scales from the appropriately marked carcasses examined on the spawning grownds.
		d	Bag, label, freeze and deliver snouts and kidney samples to the appropriate research laboratories for analysis.
		e	Digitize and summarize data, report findings, and discuss management implications
2	Estimate abundance, timing and survival of juvenile salmon and steelhead migrating from the headwaters of the Umatilla River to the Lower Columbia	a	PIT tag natural juvenile chinook and summer steelhead collected in the headwaters of the Umatilla River Basin with rotary screw traps, electrofishing and other

	(John Day and Bonneville Dam PIT tag interrogation sites).		methods
		b	Develop and submit tagging, mortality and release files to PTAGIS
		c	Extract and examine PIT tag detections from PTAGIS detection files
		d	Estimate the no. of natural smolts leaving the Umatilla River from the no. and ratio of tagged /untagged proportions of smolts trapped at the Three Mile Dam.
		e	Estimate timing and minimum survival from PIT tag detections at downriver sites
		f	Report findings and discuss management implications.
3	Estimate juvenile salmonid abundance and rearing densities in index sites and selected stream reaches in the Umatilla and Walla Walla Basins	a	Electrofish established index sites. Isolate the site with block-nets and use multiple depletion-pass methods to estimate salmonid densities.
		b	Electrofish selected stream reaches using block-nets and depletion methods to estimate salmonid densities and abundance in priority areas as defined by the Management Oversight Committee.
		c	Digitize and summarize capture data, estimate densities and abundance, examine trends, report findings and discuss management implications.
4	Estimate tribal harvest of adult salmon and steelhead returning to the Umatilla River Basin (in cooperation with BIA).	a	Design and implement a roving creel survey and phone survey depending on season and location of fisheries as determined by tribal authorities.
		b	Digitize and summarize data, estimate harvest and report findings.
5	Monitor stream temperatures in the Umatilla and Walla Walla	a	Meet with other agencies to coordinate temperature monitoring

	River Basins in cooperation with other monitoring agencies		activities.
		b	Deploy 6 Ryan RTM2000 and 30 Vemco Minilog thermographs in April of 1999. Check status and function of thermographs in July
		c	Retrieve thermographs in November of 1999. Download, summarize and graph data. Examine trends, report findings and discuss management implications.
6	Determine age, growth and life history characteristcs of bull trout, salmon and steelhead in the Umatilla and Walla Walla River Basins	a	Take scales from juvenile and adult salmon and steelhead during trapping, electrofishing and spawning surveys.
		b	Mount and press adult scale samples. Place juvenile scales directly between labeled acetate sheets at the time of sampling.
		c	Determine the proportion of unmarked adult salmon that are of hatchery and natural origin based on circuli counts from the scale focus to the first annuli.
		d	Determine the years of freshwater and saltwater rearing of adult natural steelhead and salmon.
		e	Digitize and summarize data, report findings and discuss management implications.
7	Determine and compare genetic characteristics of Umatilla River steelhead with previous genetic data. Establish genetic baseline data for Walla Walla River steelhead.	a	Collect, store and deliver steelhead samples from the Umatilla and W. W. Basins according to procedures developed by the geneticists. A lab will process the samples, analysis the data and report and discuss findings (Lab will be selected in 1998).
		b	Attach geneticists' report to annual report.
8	Improve and update the monitoring and evaluation strategies for the Umatilla and	a	Meet with Management Oversight Committee to determine monitorinag needs.

	Walla River Basins. Coordinate with the Management Oversight Committee to ensure an effective M&E program.		
		b	Modify and develop the monitoring and evaluation program to meet identified needs.

Objective schedules and costs

Objective #	Start Date mm/yyyy	End Date mm/yyyy	Cost %
1	11/1985	12/2007	25.00%
2	3/1998	12/2007	19.00%
3	6/1993	12/2007	25.00%
4	4/1993	12/2007	4.00%
5	5/1993	12/2007	2.00%
6	4/1993	12/2007	3.00%
7	3/1999	12/2009	20.00%
8	1/1992	12/2007	2.00%
			TOTAL 100.00%

Schedule constraints.
This project reports findings annually but is expected to operate at least through 2007. The Management Oversight Committee examines and modifies this M&E project annually

Completion date.
Unknown, this is a long term monitoring project that is reviewed annually.

Section 5. Budget

FY99 budget by line item

Item	Note	FY99
Personnel	6.25 FTE	$256,300
Fringe benefits	29%	$74,327
Supplies, materials, non-expendable property		$40,000
Operations & maintenance		
Capital acquisitions or improvements (e.g. land, buildings, major equip.)		
PIT tags	# of tags: 6000	$17,400

Travel		$29,000
Indirect costs	34%	$143,489
Subcontracts	CRITFC, gentic studies	$140,000
Other		
TOTAL		$700,516

Outyear costs

Outyear costs	**FY2000**	**FY01**	**FY02**	**FY03**
Total budget	$646,000	$678,000	$712,000	$748,000
O&M as % of total	0.00%	0.00%	0.00%	0.00%

Section 6. Abstract

Our project goal is to provide information to managers and researchers working to restore anadromous salmonids to the Umatilla and Walla Walla River Basins. This is the only project that monitors the restoration of naturally producing salmon and steelhead in either basin. The project objectives are to measure, estimate and report the spawning success, rearing densities and abundance, habitat quality and quantity, basin production capacity, life history characteristics, and migration timing and success of salmon and steelhead. This project also monitors tribal harvest (roving creel and telephone surveys) and water temperatures (Ryan and Vemco thermographs) in coordination with ODFW, USFS and other CTUIR projects.

In coordination with researchers and managers from the basin, we examine and modify the project annually to provide the best information to adaptively manage local salmon and steelhead. The information generated by this project also has utility for salmonid restoration efforts throughout the Columbia River Basin.

While certain monitoring activities are conducted each year, others objectives are deferred to future years because of limitations in personnel, funding, prioritization and need. Genetic sampling is an example of this. During 1992 and 1994 Currens and Schreck (1993, 1995) conducted baseline genetic sampling (allozyme electrophoresis and mtDNA) of endemic steelhead in the Umatilla Basin. We propose to sample both the Umatilla and Walla Walla River endemic steelhead in 1999 to examine genetic characteristics. We plan to collect samples and coordinate the processing, analysis and reporting with established laboratories and genetic scientists. We plan to use both electrophoresis and DNA techniques to establish genetic baseline data for Walla Walla steelhead and to re-examine Umatilla steelhead genetics. Both endemic populations are subject to potential risks through artificial propagation projects. Subsequent genetic monitoring is planned for both basins in 2004 and 2009.

In addition, this project completed a radio telemetry project evaluating the passage of fall chinook, spring chinook, and coho salmon, and summer steelhead over irrigation dams and through fish ladders in the lower Umatilla River (1993-1996). We plan to evaluate summer steelhead passage through fish ladders in the Walla Walla Basin and to

spawning areas during 2000, 2001 and 2002. Evaluations of Walla Walla spring chinook will begin when adults begin to return.

We communicate findings to researchers and managers through formal reports, monthly oversight committee meetings, annual basin operation meetings, and formal presentations at various conferences and forums.

Section 7. Project description

a. Technical and/or scientific background.

The Umatilla and Walla Walla Basin Natural Production Monitoring and Evaluation Program (UWBNPME) began in the Umatilla River basin in 1992 and was expanded to the Walla Walla Basin in 1998. This project was funded by Bonneville Power Administration (BPA Project #90-005-01). We evaluate how well natural production goals for salmon (*Oncorhynchus tshawytsha,* and *O. kisutch)* and steelhead (*O. mykiss*) are being achieved by the Umatilla Basin Fisheries Restoration Program (Table 1). The UBNPME program began ten years after the hatchery program started. The approach to the UBNPME plan originally included three phases. Phase one included collecting baseline data about life histories, survival, and natural production potential. Phase two involved adaptive management and development of a monitoring program. Phase three consisted of deploying the monitoring program (Lichatowich, 1992). The UBNPME plan placed emphasis on phase one for 1992-1997. Phases two and three began in 1997. Phase one for the Walla Walla Basin begins in 1998.

Historically, native spring and fall chinook salmon, coho salmon, and summer steelhead were present in the Umatilla River Basin. All anadromous species, except summer steelhead, were extirpated by agricultural development in the basin in the early 1900's (BOR 1988). The most notable development was the construction and operation of Three Mile Falls Dam (TMD) and other irrigation projects. The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) and the Oregon Department of Fish and Wildlife (ODFW) developed the Umatilla Hatchery Master Plan to restore the historical fisheries in the basin (CTUIR 1984 and ODFW 1986). The plan was completed in 1990 and included the following five objectives:

1) Establish hatchery and natural runs of chinook and coho salmon.
2) Enhance existing summer steelhead populations through a hatchery program.
3) Provide sustainable tribal and non-tribal harvest of salmon and steelhead.
4) Maintain the genetic character of salmonids native to and re-established in the Umatilla River Basin.
5) Produce almost 48,000 adult returns to TMD (Table 1).

This project is one of several subprojects of the Umatilla river Basin Fisheries Restoration Master Plan. Subprojects include:

Natural Production Monitoring and Evaluation, and Adult Passage Facility Evaluations (this project).
Watershed Enhancement and Rehabilitation (multiple projects)
Hatchery Construction and Operations (multiple facilities)

Satellite Facility Construction and Operations (multiple facilities)
Trap and Haul Project (multiple locations)
Juvenile Passage Facility Construction and Operation (multiple facilities)
Juvenile Passage Facility Evaluations
Adult Passage Facility Construction and Operation (multiple facilities)
Evaluation of Juvenile Salmonid Outmigration and Survival
Flow Augmentation to Increase Instream Flows

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Table 1. Original natural and artificial production goals of the Umatilla Hatchery Master Plan established by the Confederated Tribes of the Umatilla Indian Reservation and the Oregon Department of Fish and Wildlife.

Species/Race	Hatchery Production	Natural Production	Total
Adult Spring Chinook	10,000	1,000	11,000
Adult Fall Chinook	10,000	11,000	21,000
Adult Summer Steelhead	5,670	4,000	9,670
Adult Coho Salmon	6,000	Undetermined	6,000
Total			47,670

The Umatilla River Background

Summer steelhead, chinook and coho salmon were abundant in the Umatilla River prior to the 1900's. Irrigation and agricultural development throughout the basin in the early 1900's was believed to be the primary cause of the decline of steelhead and the extinction of salmon (BOR 1988). Since 1855, aquatic and riparian habitats have been degraded through irrigation diversions, water extractions, channelization, livestock grazing, logging as well as agriculture and urban development (Nielson 1950, NPPC 1987).

The Umatilla River Basin in northeast Oregon comprised 1,465,600 acres of the 6,400,000 acres of ceded CTUIR land. The Umatilla River originates on the west slope of the Blue Mountains, east of Pendleton, and flows 115 miles in a northwesterly direction to the Columbia River at RM 289. The Umatilla River Basin, hydrologic unit number 17070103 (USGS 1989), has a drainage area of 2,290 square miles. The mouth of the Umatilla River at Umatilla, Oregon, is at approximately 270 feet elevation (above mean sea level). The headwaters are as high as 4,950 feet. Mean annual precipitation ranges from 10 inches/year at Hermiston to 50 inches/year in the headwaters near Tollgate (Taylor 1993).

The basin can be roughly divided into two physiographic regions. The lower river, west of Pendleton, has cut a low valley into a broad upland plain called the Deschutes-Umatilla Plateau. Parent geologic materials of the plain are dominated by multiple layers of middle Miocene basalt flows, specifically, the Wanapum and Grande Ronde Basalts, originating 14 to 17 million years ago. Basalt bedrock outcroppings are common in the river channel and act as hydraulic controls that delay the deepening of the river channel and valley floor. On top of the Miocene basalts are Pleistocene and Holocene loess, alluvial and glaciofluvial deposits (NPPC 1990, Walker and MacLeod 1991). Currently, vegetation on the broad Deschutes-Umatilla Plateau includes dryland crops and sagebrush-grass communities. Historically, deciduous trees are abundant in riparian areas on the valley floor. However, land-use practices during the last hundred years have cleared most of these areas for irrigated agricultural and urban uses. Approximately 70 percent of riparian areas in the Umatilla River Basin were reported to be in need of improvement (ODFW 1987). Much of the Umatilla River from the Highway 11 bridge in Pendleton (RM 55.4) down stream to Echo (RM 26.3) has been channelized and straightened. Therefore few meanders, lateral scour pools or oxbows remain.

Foothills and the Blue Mountains dominate the region east of Pendleton. Lifting, faulting and folding of volcanic, sedimentary and metamorphic rock created the Blue Mountains. The middle Miocene basalts of the lower river are also the dominant parent materials in the headwaters. The river and streams have cut steep sided canyons into the layers of rock that form the higher elevations of the Blue Mountains. Exposed basalt fractured into blocks and plates while unexposed layers remained impervious to water (Walker and MacLeod 1991). The combination of steep canyon walls and impervious bedrock lends to poor ground water recharge (NPPC 1990). U.S. Geological Survey (USGS) flow data from 1904 through 1995 show stream hydrographs that reflect the various features of the basin as described above. High flows regularly occur during rainstorms and snow melt conditions. Extreme low flows are common during summer and dry conditions. This effect is less pronounced in the near pristine North Fork Umatilla Wilderness Area and the North Fork of Meacham Creek, apparently because of the lack of human disturbance, higher elevation of the headwaters, developed soils, large woody debris and climax plant communities. Vegetation distribution patterns upstream from Pendleton are typical for the Blue Mountains. Grasses and small shrubs dominate the drier, south facing slopes. Conifers dominate the north facing slopes, higher elevations and moderately wet areas.

Walla Walla River

Spring chinook salmon were also present in the Walla Walla River Basin in the 1800s. Currently, the headwaters are in good condition and could support spring chinook. This project begins monitoring in 1998 and will be one of several logical components of a comprehensive restoration effort in the Walla Walla system

The Walla Walla River Basin shares many physical and historical features with the Umatilla Basin as described above. Once abundant spring chinook and steelhead were decimated early in this century by the construction of many irrigation dams that completely dewatered the stream channel (Nielson 1950). The lower reaches of the Walla Walla Basin are primarily agricultural lands. Topography, annual precipitation and vegetation gradually changes from dry farms and rangelands (bunchgrasses, wild rye and sagebrush) of the lower elevations to the wetter forests of the Blue Mountains (white fir, mixed conifers and shrub understories).

b. Proposal objectives.

Objective 1. Monitor spawning activities of hatchery and natural adult spring chinook, fall chinook and coho salmon, and summer steelhead in the Umatilla River Basin. Monitor summer steelhead spawning in the Walla Walla River Basin. This is a monitoring objective with an underlying hypothesis that adult spawning will increase restoration efforts.

Objective 2. Estimate abundance, timing and survival of juvenile salmon and steelhead migrating from the headwaters of the Umatilla River to the lower Columbia (John Day and Bonneville Dam PIT tag interrogation sites). This is a motoring objective with the underlying hypothesis that natural smolt abundance and survival will increase over time as a direct result of adaptive management and rehabilitation efforts.

Objective 3. Estimate juvenile salmonid abundance and densities at index sites and selected reaches in the Umatilla and Walla Walla River Basins. This is a monitoring program with an underlying hypothesis that distribution and rearing densities of natural juvenile salmon and steelhead will increase though rehabilitation efforts. .

Objective 4. Estimate tribal harvest of adult salmon and steelhead returning to the Umatilla River Basin (assist BIA personnel). This is a monitoring objective with an underlying hypothesis that tribal harvest for all anadromous species will increase through rehabilitation efforts.

Objective 5. Monitor stream temperatures in the Umatilla and Walla Walla River Basins in cooperation with other monitoring agencies. This is a monitoring objective with an underlying hypothesis that watershed rehabilitation efforts will improve temperature profiles over times.

Objective 6. Determine age, growth and life history characteristics of bull trout (*Salvelinus confluentus*), salmon and steelhead in the Umatilla and Walla Walla River Basins. We hypothesize that there will be no detectable differences in age, growth or life history characteristics between past and current populations.

Objective 7. Determine and compare genetic characteristics (DNA and electrophoresis) of Umatilla River steelhead with previous genetic data. Establish genetic baseline data for Walla Walla River steelhead. We hypothesis that artificial propagation projects will not change genetic characteristics of Umatilla and Walla Walla River natural steelhead overtime.

Objective 8. Improve and update the monitoring and evaluation strategies for the Umatilla and Walla Walla River Basins. Coordinate with the Management Oversight Committee to prioritize efforts to ensure the most effective and adaptive monitoring and evaluation program available resources can provide. This objective is based on the underlying assumption that the best adaptive monitoring program is maintained when research and management regularly explore, evaluate and prioritize monitoring needs.

This monitoring and evaluation project produces information in the form of formal reports (see Section 7,d and g.). Managers and researchers use our information to adaptively manage local steelhead and salmon stocks. Our information also has application to salmonid restoration efforts throughout the Columbia River Basin. Annual reports, quarterly reports, monthly oversight committee meetings, annual basin operation meetings and formal presentation at various conferences and forums all provide technology transfer.

c. Rationale and significance to Regional Programs.

This project is the measuring tool of natural production restoration efforts in the Umatilla and Walla Walla River Basins. Furthermore, it examines how reasonable natural production goals are under existing and potential conditions and how well hatchery salmon and steelhead reproduce naturally. This project has core monitoring activities that are carried out each year as well as activities that address special information needs for the adaptive management of local salmonid stocks (adult passage evaluations, genetic monitoring). Our project cooperates directly with other project such as Project 89-024-041 (Evaluation of Juvenile Salmonid Outmigration and Survival in the Lower Umatilla River). We PIT tag natural juvenile salmonids in the headwaters and they interrogate naturally produced salmonids during their evaluations near the river's mouth. We also collect kidney samples and coded wire tags from spawning carcasses for ODFW. This project is an integral part of the Umatilla and Walla Walla Basin Restoration projects outlined in section 8 below.

The Umatilla Basin fisheries restoration planning documents (Lichatowich, 1992, ODFW 1985, NPPC 1990, and others) identified critical uncertainties regarding the endemic steelhead response to supplementation efforts. Our monitoring objectives stem from the Lichatowich (1992) paper and from the critical uncertainties of supplementation as briefly outlined below.

The primary goal of supplementation as applied to steelhead in the Umatilla and Walla Walla Restoration Projects is to increase natural production and produce surplus adults for harvest (CTUIR 1984, ODFW 1986). The effects of releasing hatchery reared salmonids with wild and natural salmonid populations have been explored from a variety of perspectives. Strategies to examining this topic have ranged monitoring genetic heterozygosity and the persistence of unique alleles to evaluating the performance of hatchery and wild salmonids spawning naturally. Some researchers have discussed and provided compelling evidence indicating hatchery programs may decrease the production on natural salmonids. (Nickelson et al. 1986, Vincent 1987, Leider et al. 1990, Flemming and Gross 1991, Steward and Bjornn 1990). Others have advised using supplementation to restore and enhance natural populations (CTUIR 1994, ODFW 1986, Bowles and Leitzinger 191, NPPC 1987 and 1990).

The effects of supplementation on the genetics of natural populations have been of primary concern in the fisheries literature (Reisenbichler and Phelps 1989, Meffee 1992, Steward and Bjornn 1990, Ferguson et al. 1991). Research in stock genetics has demonstrated that hatchery spawning practices can have a variety of effects on population genetics. Allendorf and Phelps (1980) found hatchery cutthroat trout (*O. clarki)* had lost genetic variation over time. Reisenbichler and Phelps (1989) found significant genetic differences between hatchery and wild steelhead in northwest Washington. They attributed these genetic differences to hatchery broodstock selection and spawning practices. Ferguson et al. (1991) found ancestral and descendant rainbow trout did not have significantly different allelic frequencies when modern breeding techniques were practices. Byrne et al (1992) modeled the genetics of steelhead supplementation strategies using an equally fit broodstock with different alleles. He demonstrated that often "supplementation of native stocks with hatchery fish causes replacement, not enhancement of native fish." Byrne (et al. 1992) and Meffe (1992) both emphasized that to enhance natural steelhead, carrying capacity of the rearing and migratory habitat must be restored and maintained.

The Umatilla hatchery program minimizes genetic risks by breeding endemic naturally produced steelhead with modern techniques (matrix spawning). Occasionally first generation hatchery adults are used for spawning during shortages (Rowan 1991, 1994, 1995). Long term monitoring of the performance and genetics of the Umatilla steelhead is critical.

Supplementation may impact survival, growth and behavior of natural salmonids through predation, competition, disease transmission, and behavior modification. Predation by hatchery fish on wild fry has been documented. However, researchers report that hatchery steelhead smolts prey primarily on macroinvertebrates (Parkinson et al. 1989, Hillman and Mullan 1989, Steward and Bjornn 1990, Cannamela 1992). However, Horner (1978) found some hatchery steelhead became highly piscivorous with salmonids comprising 50% of their diets. Cannemela (1993) examined the stomachs of 6,700 hatchery steelhead smolts for predation on naturally produced chinook fry. Cannemela estimated that hatchery smolts prey on chinook fry at low rates (0.0014 fry/smolt).

Competition and displacement occurs when individuals compete for limited resources (Chapman 1966, Everest and Chapman 1972). We have found little evidence for increased competition with natural steelhead from hatchery juveniles in rearing areas of the Umatilla Basin. Hatchery releases generally occur during moderately high flows when space and food do not appear to be limiting. Furthermore, most hatchery salmonids start their downstream migration directly after release. During electrofishing surveys (CTUIR 1994, Contor et al. 1995a, 1996a, 1998a) few residual hatchery fish have been captures. Boston Canyon Creek, near the Bonifer Acclimation Facility was and exception. We estimated 1,100 hatchery steelhead residualized there in 1993. Natural steelhead, over 75 mm, were apparently displaced by hatchery steelhead. Researchers report that most residuals remain near the point of release (Cannamela 1992, 1993, Hillman and Mullan 1989). Hatchery residuals in the Umatilla Basin exhibit the same behavior. We estimated that approximately 4,000 hatchery steelhead residualize each year in Boston Canyon Creek, Meacham Creek, Minthorn Springs Creek and in the mainstem of the Umatilla River (CTUIR 1994, Contor et al. 1995). That was a summer residualization rate of 2.7% and represents 0.6% of the total juvenile steelhead in the basin. Residualization rates in the Umatilla are similar to Viola and Schucks' (1991) findings in southeast Washington (9.9% in early summer to 0.8% in October).

Hillman and Mullan (1989) observed behavior alterations of natural chinook fry in the presence of hatchery reared chinook. Natural chinook fry not subject to the hatchery releases showed no change in behavior. However, natural chinook behavior did not change during hatchery steelhead releases. Vincent (1987) demonstrated dramatic increases of natural brown trout (*Salmo trutta*) and rainbow trout population once stocking hatchery rainbow trout ceases. Vincent reported that stocking increased the natural mortality rates of wild trout. Bachman (1994) observed frequent and long antagonistic encounters between wild hatchery reared trout. These encounters often resulted in the exhaustion of wild trout. Poor survival, excessive activity and energy expenditure for "unnecessary aggressive behavior" by hatchery trout was also reported by Mesa (1991). Petrosky and Bjornn (1988) found that stocking rainbow trout at lower densities did not change the abundance, survival and growth of wild rainbow and cutthroat trout.

The primary assumptions of steelhead supplementation in the Umatilla Basin include: 1, there are significant amounts of underutilized quality habitat; 2, the quickest way to utilize vacant habitat is to flood the system with hatchery adults that will reproduce naturally, and 3, the risks to wild steelhead have been minimized and are outweighed by potential benefits. Monitoring and evaluations based on extensive habitat and biological surveys (CTUIR 1994, Contor et al. 1995a, 1996a, 1998a) indicate that most all of the quality habitat in the basin is fully utilized (densities of juvenile steelhead have ranged from 40 to 400 fish/100m$^{2)}$. Furthermore, there are considerable remaining questions on the effectiveness of hatchery steelhead to reproduce naturally. Chilcote (et al. 1986) and Campton (et al. 1991) concluded that hatchery steelhead reproduce at 28% and 15% of the rate of natural steelhead, respectively. Leider (et al. 1990) found that the progeny of hatchery steelhead did not survival as well as progeny form natural steelhead. Nickelson (et al. 1986) found that supplementing hatchery coho salmon reduced the number of wild coho juveniles but did not increase the number of adult returns.

Tribal and State managers speculate that hatchery adults reproduce at higher rates than Campton (et al. 1991) estimated. We have no data to confirm this supposition. We do know, however, that since 1981 when hatchery supplementation began, the number of naturally produced steelhead has decreased substantially. The decrease in natural adult returns in the Umatilla Basin follows the trends as adult returns in the John Day Basin (un-supplemented), Walla Walla, Grande Ronde, and Imnaha Basins (supplemented). Based on adult returns and population modeling it does not appear that supplementation has benefited natural steelhead (Contor et al. 1995, Chilcote 1997). There remains the distinct possibility that at least as many natural adult steelhead would have been produced without supplementation efforts. As Byrne (et al. 1992) suggests, supplementation may replace natural steelhead. This would be expected if Chilcote's (et al. 1986) and Campton's (et al 1991) findings hold true for the Umatilla River hatchery steelhead spawning success. Based on our evaluations during the last five years, increases in the natural production of juvenile steelhead will come through restoration of habitat. Increases in adult returns of natural steelhead will depend on improvements in smolt to adult survival (see Chilcote 1997).

From a research perspective, it is imperative that we examine the risks and benefits of supplementation in detail. Many of our research objectives are designed to address the uncertainties outlined above. However, we recommend a more detailed and definitive examination of supplementation. Unfortunately, personnel and funding constraints led to the removal of genetic monitoring and some supplementation objectives from past proposals. Genetic studies were postponed from 1997 to 1998 and then to 1999. Some objectives to critically test supplementation have been dropped indefinitely.

Managers expect positive results from supplementation efforts and would like to document results for effective evaluation. Researchers and managers concur that reliable methods to evaluate supplementation are lacking. Without clear evaluation of supplementation projects, a management paradox may evolve. If natural populations begin to decline, increased supplementation would be implemented to “rescue” the natural runs. However, without a good measurement of supplementation effects, there remains a real probability that supplementation will replace natural steelhead as predicted by Byrne (et al. 1992). Supplementation could assist natural steelhead or magnify their decline.

The utility of a reliable method to evaluate supplementation is clear. While our proposal to develop a supplementation evaluation tool has been postponed, its usefulness warrants an introduction in this forum for consideration by other projects. During future years, we hope to coordinate the development, testing and utilization of a “progeny mark.” A progeny mark would evaluate the natural reproductive capabilities of hatchery and wild steelhead and salmon. The mark would be a compound or element applied to adult females and passed on to her eggs prior to spawning. During early development, the marking material would be deposited in the center of the progeny’s otolith (strontium, strontium compounds or other materials may be feasible). Extraction and microscopic chemical examination of otoliths from parr, smolts and adults would indicate the marked status of the female parent. When successfully developed, this tool will be useful in evaluating supplementation and restoration efforts throughout the Columbia Basin. Different group marks could be placed on hatchery and natural adults examined (and released to spawn) at routine trapping facilities in systems such as the Umatilla and Walla Walla Rivers. Sampling naturally produced progeny from those basins would indicate the reproductive success of the marked groups. Otoliths could be collected from unmarked broodstock, smolts collected at traps, and kelts collected at passage facilities. The development of progeny marks will require testing to determine suitable marking materials, delivery agents and application procedures. The marking material must be detectable, persistent, and benign to humans and all stages of the progeny’s development.

d. Project history

This project began in 1992 and is in its sixth year. Listed below are dates, project numbers, contract numbers, costs, project reports and documents, and a summary of major achievements and management implications.

Year one: September 30, 1992 through September 29, 1993; BPA project no. 90-005-01; contract no. DE-B179- (92BP75349); approximate projected costs $377,000, and approximate actual cost $352,000.

Reports and documents: statement of work (Contor 1993); annual report (CTUIR 1994), and quarterly reports.

Summary of major achievements (1992-1993): hired personnel; began habitat surveys (after Moore et al. 1993); completed habitat survey training; installed and operated rotary screw traps; initiated core monitoring program and baseline data collection; conducted eight months of spawning surveys throughout the basin; started biological surveys, temperature monitoring, steelhead genetic baseline data collected (Currens and Schreck 1995). Prespawning mortality of spring chinook was high except in the upper reaches of the Umatilla River.

Year two: September 30, 1993 through September 29, 1994; BPA project no. 90-005-01; contract no. DE-B179-(92BP75349); approximate projected costs $495,000, and approximate actual cost $427,000.

Reports and documents: BPA project review (Contor 1994); statement of work (Contor et al. 1994); annual report (Contor et al 1995a), and quarterly reports.

Summary of major achievements (1993-1994): continued habitat surveys, rotary screw trapping, spawning surveys, biological surveys and temperature monitoring; quality habitat found to be less abundant that Master Plan estimated, and quality steelhead rearing habitat more fully utilized than Master Plan estimated

Year three: September 30, 1994 through September 29, 1995; BPA project no. 90-005-01; contract no. DE-B179-(92BP75349); approximate projected costs $615,000, and approximate actual cost $605,000.

Reports and documents: BPA proposal (Contor 1995). statement of work (Contor et al. 1995b); annual report (Contor et al. 1996a), and quarterly reports.

Summary of major achievements (1994-1995): added the adult passage (radio telemetry) evaluations (Kissner 1992, Volkman 1993 and 1994); continued habitat surveys, rotary screw trapping , spawning surveys, biological surveys, and temperature monitoring. Telemetry results suggested Feed Canal Dam delays adult migration (Contor et al 1996a, 1998a).

Year four: September 30, 1995 through September 29, 1996; BPA project No. 90-005-01; contract no. DE-B179-(92BP75349); approximate projected costs $649,000, and approximate actual cost $524,000.

Reports and documents: BPA proposal (Contor 1996); statement of work (Contor et al. 1996b). annual report (Contor et al. 1998a in press), and quarterly reports.

Summary of major achievements (1995-1996): completed adult passage evaluations; Feed Canal Dam continued to delay migrating adult salmon and steelhead; continued habitat surveys, rotary screw trapping, spawning surveys, biological surveys, and temperature monitoring; freeze branded juvenile outmigrants (after Knight 1990) but obtained less than 20 recaptures.

Year five: September 30, 1996 through September 29, 1997: BPA project no. 90-005-01; contract no. DE-B179-(92BP75349); approximate projected costs $650,000, and approximate actual cost $470,000.

Reports and documents: BPA proposal (Contor, C. R. 1997); statement of work (Contor et al. 1997); annual report (Contor et al. 1998b in prep.), and quarterly reports.

Summary of major achievements (1996-1997): Completed habitat surveys; continued rotary screw trapping, spawning surveys, biological surveys and temperature monitoring; decrease in expenditures in response to funding reductions created a high carryover; photonicaly marked juveniles salmonids but had no recaptures; photonic tag retention was good on test groups;

Outyear plans for monitoring and evaluation changed drastically; genetic monitoring dropped from1998 work plan; supplementation evaluations were dropped indefinitely; one biologist and two technicians transferred to other programs; key research personnel interviewed but then not hired at the last minute; habitat, temperature and fish data not analyzed in depth; tasks and objectives reduced considerably from the Lichatowich Plan (1992).

Year Six (Current Year): October 1, 1997 through September 30, 1998; BPA project no. 90-005-01; contract no. DE-B179-(92BP75349), and approximate projected costs $546,000.

Reports and documents: BPA Proposal (Contor 1998); 1988-98 statement of work (Contor et al. 1998c in prep.); annual report (Contor et al. 1999 in prep.), and quarterly reports.

Summary of planned activities (1997-1998): Expand project to the Walla Walla Basin; develop Walla Walla Monitoring Plan; continue rotary screw trapping; begin PIT tagging; continue spawning surveys, biological surveys and temperature monitoring in the Umatilla Basin; begin temperature monitoring in the Walla Walla Basin; coordinate and prepare for genetic monitoring in 1999; genetic monitoring will follow work done by Currens and Schreck (1995).

e. Methods.

Objective 1. Monitor spawning of hatchery and natural adult spring chinook, fall chinook and coho salmon, and summer steelhead in the Umatilla River Basin. Monitor summer steelhead spawning in the Walla Walla River Basin.

Task 1.1 Document the number and locations of redds and examine carcasses in index areas and other areas throughout both basins as conditions allow.

Task 1.2 Estimate survival to spawning and total egg deposition by species, reach and basin.

Task 1.3 Collect and record length, sex, pre and post-spawn mortality data, coded wire tags, marks, PIT tags, fin clips, kidney samples and scales from the appropriate carcasses examined on the spawning grounds.

Task 1.4 Bag, label, freeze and deliver snouts and kidney samples to the appropriate research laboratories for analysis.

Task 1.5 Digitize and summarize data, report findings and discuss management implications.

Objective 1. Methods

We conduct spawning ground surveys to enumerate summer steelhead, spring and fall chinook and coho salmon redds and sample mortalities in various reaches of the Umatilla River Basin. We repeat surveys in areas with spawning or holding adults. Other areas are surveyed fewer times if few spawners are observed. Poor water conditions may also prevent surveys. We wear polarized glasses to assist observation. We do not probe debris jams or throw rocks into holding pools to minimize stress on prespawning salmonids. Two surveyors walk three to four miles daily. They walk alone along the margins of the smaller tributaries or together on opposite banks.

Redds are judged to be complete based on redd size and depth, location, and amount and size of rock moved. All redds are reviewed by our most experienced surveyors for consistency. Redds are marked with orange flagging labeled with the date, location, species and number of males and females observed on or near the redd. Crews also record information in data books. For each redd, surveyors record the stream name, location, date the redd was first observed, sex and number of fish observed on or near the redd and fish sampled in the vicinity and habitat type.

Carcasses found during the survey are measured from the middle of the eye to the hypural plate (MEHP). Fork length is also recorded if severe caudal fin erosion has not occurred. We describe obvious injuries and attempt to determine the cause of death in prespawning salmonids. We cut open carcasses to determine egg retention of the females and spawning success of the males. Prespawning mortality is defined as death of a fish before spawning. Females with egg retention estimated near 100% and males with full gonads are classified as prespawning mortalities. Tails of sampled fish are removed at the caudal peduncle to prevent re-sampling. We collect snouts from salmon and steelhead with coded wire tags (based on fin clips) by cutting behind the orbit down to the mouth. Snouts are placed in plastic bags and given an individual snout number for identification. Snouts and accompanying biological data are sent to ODFW's, Mark Process Center in Clackamas, Oregon for coded wire tag extraction and reading. Kidney samples are collected on the spawning ground from spring chinook with coded wire tags that have been dead for less than 48 hours. Samples are frozen and taken to the ODFW pathology laboratory in LaGrande for analysis.

Objective 2. Estimate abundance, timing and survival of juvenile salmon and steelhead migrating from the headwaters of the Umatilla River to the lower Columbia (John Day and Bonneville Dam PIT tag interrogation sites).

Task 2.1 Pit tag natural juvenile chinook and summer steelhead collected in the headwaters of the Umatilla and Walla Walla River Basins with rotary screw traps, electrofishing and other methods.

Task 2.2 Develop and submit tagging, mortality and release files to PTAGIS.

Task 2.3 Extract and examine PIT tag detection files from PTAGIS.

Task 2.4 Estimate the number of natural smolts migrating from the mouth of the Umatilla River based on the number and ratio of tagged/untagged natural smolts observed at the Three Mile Dam (TMD) juvenile trap.

Task 2.5 Estimate timing and minimum survival from PIT tag detections at all downriver interrogation sites.

Task 2.6 Report findings and discuss management implications

Objective 2. Methods

We operate two rotary screw traps five feet in diameter, (E.G. Solutions, Inc. design) to capture emigrating juvenile salmonids. One trap is installed near the USGS gagging near Gibbon in the Umatilla River (RM 81.7). The trap operates from September to June with starting dates depending on flows. The second trap is installed in Meacham Creek (RM 1.5) and is operated from October through May. Low flows prevent trapping through the summer months.

We record the following data daily: trap site, date, time, number and species of fish captured, lengths, marks, clips, number of fish marked and released and comments regarding weather, stream flows and trap effectiveness. Non-salmonid species are counted or estimated when large numbers are captured.

Trapping catch efficiency is estimated by marking salmonids with temporary clips of the outside ¼ of a fin.. Marked salmonids are released approximately 100 to 1,000 m above the rotary traps during the day depending on flows. Recaptured salmonids are counted, measured and released below the trap. Additional marked juvenile salmonids are placed in the livewell for 24 hours to determine containment rates. Minimizing escapement from the livewell through containment monitoring (and repair when necessary) increases effective catch rates. Depending on availability, we use one to 100 fish of a given species and size class for mark-recapture and containment trials.

Trap efficiency estimates and total migrants at the Imeques trap site are calculated by averaging weighted, multiple, running means from catch, mark and recapture trials of three to 13 days. Total fish migrating past the trapping site during the multiple running time periods of 3 to 13 days are calculated by dividing total catch by the mean catch rate for the time period. No estimates are made when the traps are not operating due to floods, ice, heavy debris or repair.

Assumptions used to estimate trap catch rates and the number of salmonids migrating past the traps include: 1) marked and unmarked salmonids are actively migrating past the trap; 2) fish downstream of the trap did not return to risk capture again; 3) previously captured, handled and marked fish released upstream of the trap have an equal probability of capture as un-handled fish; 4) recaptured fish escape from the livewell at the same rate as un-handled fish; 5) marks on recaptured fish are correctly recognized and recorded by samplers, and 6) no mortality of marked fish occurs between the release site and the trap.

We will PIT tag all age 1+ chinook and all steelhead with smolt or partial smolt characteristics. After fish are anesthetized with MS222 (tricaine methane-sulfonate), trained personnel PIT tag them by hand with sterile syringes. PIT tagged fish will be measured, held for observation and released. We will submit the appropriate tagging and release files to PTAGIS according to the procedures detailed in the most recent PIT Tag Specification Document (Stein, 1997). We estimate total outmigration of natural juvenile chinook and steelhead at TMD with the following formula:

$$\left[\frac{\dfrac{T}{R-1}}{C}\right](M)(TRR)$$

Where T = Number of PIT tagged individuals released at upper traps.
R = Number of PIT tagged observed at the lower traps.
C = Total number of tagged and untagged individuals observed at the lower traps.
M = The migration ratio of tagged individuals (1-the residualization rate).
TRR = Mean tag retention rate.

We assume that tagged fish have the same mortality and residualization rate as untagged fish. We assume that 99% of all tags will be retained and function at the lower river detection sites even though only a small proportion may be detected. We assume 1+ chinook and steelhead with smolt characteristics will migrate to the ocean during the same outmigration season.

Objective 3. Estimate juvenile salmonid abundance and rearing densities in index sites and selected stream reaches in the Umatilla and Walla Walla River Basins.

Task 3.1 Electrofish established index sites. Isolate the site with block-nets and use multiple depletion-pass methods to estimate salmonid densities.

Task 3.2 Electrofish selected stream reaches using block-nets and depletion methods to estimate salmonid densities and abundance in priority areas as defined by the Management Oversight Committee.

Task 3.3 Digitize and summarize capture data, estimate densities and abundance, examine trends, report findings and discuss management implications.

Objective 3. Methods

We use backpack electroshockers to sample juvenile salmonids. Block-nets are used to contain the fish within a measured area. Salmonids are captured with dip nets and removed on successive electrofishing passes until a depletion rate of at least at 60% is achieved. The same individual electrofishes in a similar manner for the same number of seconds (or slightly more) as the previous pass. Electroshocker settings (i.e. volts, pulse) remained constant for each removal pass. Additional passes are not conducted if salmonids are neither captured nor observed during the first pass.

Captured salmonids are placed in a livewell until the completion of all passes. Fish are identified to species, measured (fork length, mm) and inspected for fin clips, brands or marks. We record injuries, signs of disease or stress. Juvenile spring chinook salmon are not differentiated from juvenile fall chinook salmon. Anadromous rainbow are not differentiated from resident rainbow.

Crews collect scale samples from a wide variety of fish sizes for age and growth determination. We remove approximately 6-12 scales from an area two scale rows above the lateral line, posterior to the dorsal fin, and anterior to the adipose fin. Scales are mounted in the field directly onto clear mylar envelopes. Stream name, site, date, species and fork length are recorded on the mylar. No additional handling or mounting is required before reading.

Estimates of salmonid abundance are calculated with a maximum-likelihood model (Van Deventer and Platts 1989) from the number of salmonids captured during successive electrofishing removal passes. Densities are estimated by dividing estimated salmonid abundance by measured wetted channel area.

We sample established index sites located throughout the Umatilla River Basin to monitor salmonid densities, species composition and relative abundance through time. Index sites are a minimum of 100 m in length and may be more that 300 m. The lower and upper boundary of each site is marked with numbered tags to assist consistent sampling. Most tags were placed on living trees or on wooden posts outside of the active channel to avoid tag loss during high flows. Crews measure, photograph and describe sampling sites. Each index site is marked on a Umatilla River Basin map.

We sample index sites during August and early September when flows and conditions are the most consistent. We sample additional sites to evaluate distribution and seasonal habitat utilization. We also conduct intensive salmonid density surveys with similar methods but sampling up to 15 % of the entire stream. Stratified-sample designs are used to select multiple sampling sites for intensive reach surveys.

Objective 4. Estimate tribal harvest of adult salmon and steelhead returning to the Umatilla River Basin (assist BIA personnel).

Task 4.1 Design and implement roving creel surveys and telephone surveys depending on the season(s) and location(s) of the fishery (ies) as determined by Tribal Authorities.

Task 4.2 Digitize and summarize data, estimate harvest, and report findings.

Objective 4. Methods

The variability from year to year of the tribal angling seasons and locations often requires significant modifications of earlier survey designs. We employ non-uniform probability roving creel surveys designed after Malvestuto (1983 and Malvestuto et al. 1978). However, angling effort can be so light that the typical creel surveys generally do not yield sufficient data to calculate effort, catch rates and harvest. The most consistent index for tribal harvest has been telephone surveys of tribal anglers. The unique nature of the local community allows a more comprehensive index of harvest by telephone and off river interviews than more traditional sport fisheries.

Objective 5. Monitor stream temperatures in the Umatilla and Walla Walla River Basins in cooperation with other monitoring agencies.

Task 5.1 Meet with other agencies to coordinate temperature monitoring activities.

Task 5.2 Deploy 6 Ryan RTM2000 and 30 Vemco Minilog thermographs in April of 1999. Check status and function of thermographs in July 1999.

Task 5.3 Retrieve thermographs in November of 1999. Download, summarize and graph data. Examine trends, report findings and discuss management implications.

Objective 5. Methods

CTUIR, ODFW, U.S. Forest Service (USFS) and U.S. Bureau of Reclamation (BOR) coordinate the deployment of 53 thermographs and 4 HYDROMET stations in the Umatilla River Basin to maximize consistency and coverage without duplicating effort. We initialize, download and deploy the thermographs in the office or field with a portable computer. We install new batteries in the RYAN RTM 2000s as well as clean and inspect the seals and clamps. Steel chains or cables anchor the units to large trees or boulders on the shore. Thermographs and cables are concealed to minimize tampering. Crews take photographs and write detailed descriptions of each thermograph location. We also draw vicinity maps and mark 7.5 minute topographic maps. Temperature data will be examined in relation to past data, water quality standards, and critical levels published in the literature (Black 1953, Brett 1952).

Objective 6. Determine age, growth and life history characteristics of bull trout, salmon and steelhead in the Umatilla and Walla Walla River Basins.

Task 6.1 Take scale samples from juvenile and adult bull trout, salmon and steelhead during trapping, electrofishing, artificial spawning and natural spawning surveys.

Task 6.2 Mount and press adult scale samples. Place juvenile scales directly between labeled acetate sheets at the time of sampling.

Task 6.3 Determine the proportion of unmarked adult salmon that are of hatchery and natural origin based on circuli counts from the scale focus to the first annuli.

Task 6.4 Determine the years of freshwater and saltwater rearing of naturally produced adult salmon and steelhead.

Task 6.5 Digitize and summarize data, report findings and discuss management implications.

Objective 6. Methods

We take five scales from the preferred area (two scale rows above the lateral line on the left side of the fish in a diagonal line between the posterior edge of the dorsal fin and the anterior edge of the anal fin). Because of the high incidence of regenerated scales on adults, we also take scales from the other side of the fish two rows below the lateral line in the preferred area). We mount adult scales on gum cards and press them into cellulose acetate. Length, sex and species are kept with each scale sample. We collect approximately ten scales from each juvenile salmonid sampled in the preferred area. Scales are spread out between folded strips of labeled mylar. Adult and juvenile scales are analyzed under a microfiche reader at magnifications of 42x and/or 72x.

We age scales with European Method of age designation: (i.e. age 1.2 was a fish that migrated from freshwater during its second year of life, spent two winters rearing in the ocean). One or two readers examine all scales. Both readers examine scales with questionable ages. Differences in age interpretation are discussed. If a clear interpretation can not be determined, the scale is eliminated from the sample.

Life history characteristics of natural salmonids in the Umatilla and Walla Walla Basins will be compiled from findings obtained from trapping, electrofishing, reading scales and examining natural adult return data provided by this and other projects (Contor et al. 1998a, Zimmerman and Duke 1995, Rowan 1991, Knapp et al. 1996 and 1997).

Objective 7. Determine and compare genetic characteristics (DNA and electrophoresis) of Umatilla River steelhead with previous genetic data. Establish genetic baseline data for Walla Walla River steelhead.

Task 7.1 Collect, store and deliver steelhead samples from the Umatilla and Walla Walla Basins according to procedures developed by geneticists from the selected laboratory. One or several laboratories will process the samples, analyze the data, report findings, and discuss management implications (the laboratory will be selected in 1998).

Task 7.2 Attach the geneticist report to the annual report.

Objective 7. Methods

Because genetic analysis is technical in nature, we will develop a contract with a geneticist and laboratory to assist us in the sample design and sample collection protocol. Methods will likely follow Nie (1974), and Currens and Schreck (1995). We will ship samples to the laboratory for processing. The laboratory results will be forwarded to a geneticist for analysis and report preparation. During 1998, we will work out the details for the field season of 1999. The tentative schedule calls for field collection in the spring and summer of 1999, laboratory analysis during the summer and fall of 1999 and a completed report by February of 2000 for inclusion into the 1998-1999 annual report.

Objective 8. Improve and update the monitoring and evaluation strategies for the Umatilla and Walla Walla River Basins. Coordinate with the Management Oversight Committee to ensure an effective and adaptive monitoring and evaluation program.

Task 8.1 Meet with administrators, managers and researchers to determine monitoring and evaluation needs.

Task 8.2 Modify and develop the monitoring and evaluation project to meet continuing and developing information needs.

Objective 8. Methods

The methods are sufficiently defined above. We will also continue to examine similar and relevant projects conducted in the Columbia River Basin (such as Bowles and Leitzinger 1991, Bugerta et al. 1990, Kucera et al. 1991, Lofy and McLean 1995a and 1995b, Mullan et al. 1992).

f. Facilities and equipment.

Office Space and Equipment: four offices work areas; six desks; six chairs; four Pentium II computers with current network software, zip drive backup storage drives, CD rom drives and power backup and surge protectors; two HP Laser printers and use of one network HP Laser printer; six full size file cabinets; five book shelves, and one lockable storage cabinet.

Locking Storage Facilities: use of one large fenced lot with locking gates, and two locked basement storage areas with shelving.

GSA Vehicles: primary use of one 4x4 GMC Suburban with winch, one 4x4 Ford Bronco with winch, one Ford 4x4 pickup with winch, and two Dodge 4x4 extended-cab pickups without winches; two way radios for each vehicle; one 5x10' flatbed trailer.

Field Equipment: two rafts; three Model 12 Smith-Root backpack electroshockers with batteries and chargers; two E.G. Solution rotary screw traps; four large winches for trap adjustment; one four wheeler; two Honda trail bikes; two wet suits, two dry suits, associated gear and two dive lights; two ATV trailers, and three box traps with 360 feet of 5 inch PVC pipe (for trapping juveniles migrating down small streams).

Cameras and Instruments: six Ryan RTM2000 thermographs; 21 Vemco Minilogger thermographs (we will purchase 10 more in 1999), one digital camera, three film cameras, four Suunto climometers, four Suunto mirror compasses, four mass scales, two range finders; five LOTEK SRX 400 Telemetry Receivers with associated dry boxes, cable, and antennas; two Panasonic time lapse VCR recorders; two Panasonic video cameras with lenses, tripod and power supplies (passage monitoring); one EyeCom 3000, full size COM reader (for scale analysis); one Micronta electronic multitesters;

Hand Tools and Supporting Equipment: 4000 W Coleman generator; Makita circular, reciprocating and jig saws; Makita ½ " drill; three tool boxes with assorted wrenches, hammers, sockets and other tools; numerous nets, buckets and tubs for handling fish.

Contracted Expertise and Laboratory Services: Contracting with established genetic researchers and laboratories will provide the needed expertise and equipment for quality genetic evaluations.

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Section 8. Relationships to other projects

This project is an integral part of the Umatilla and Walla Walla Basin Restoration Efforts. It is the logical monitoring component to measure the natural production benefit from the projects outlined below.

- Watershed Enhancement and Rehabilitation Projects
  - Squaw Creek Watershed Project – Anadromous Portion, No. 9506000
  - Umatilla River Basin Anadromous Fish Habitat Enhancement, No. 710001
  - Umatilla Habitat Improvement / ODFW – Implementation / O&M. No. 8710002
  - Coordination of Watershed Projects in the Umatilla River Basin. No. 9609500
- Hatchery Construction and Operations Projects
  - Umatilla Hatchery Satellite Facilities Operation and Maintenance, No. 8343500
  - Umatilla Hatchery Satellite Facilities Planning, Siting, Design and Construction, No. 9101400
  - Umatilla Hatchery Operations and Maintenance, No. 9803500
  - Umatilla Hatchery – Monitoring/Evaluation Project, No. 9000500
- Adult Passage Facility Construction and Operation on the Umatilla and Walla Walla Rivers (several projects and multiple facilities)
- Flow Augmentation to Increase Instream Flows in the Umatilla River (several projects and multiple facilities).
- Umatilla and Walla Walla River Basin Trap and Trap and Haul Project, No. 8802200

In addition, we provide lamprey catch data to the Pacific Lamprey Research and Restoration Project, No. 9506000.

We depend on Columbia Basin PIT Tag Information System, No. 9008000 to coordinate PIT tagging information.

We also coordinate with the ODFW research project "Evaluation of Juvenile Salmonid Outmigraion and Survival in the Lower Umatilla River, No 8902401. They recapture our marked fish near the mouth of the Umatilla River. They are an essential part of our natural production migration studies.

Section 9. Key personnel

Gary James
Fisheries Program Manager

Employment

1982 – Present, Fisheries Program Manager (0.167 FTE) Confederated Tribes of the Umatilla Indian Reservation. Duties: manage Tribal Fisheries Program; supervise project leaders and coordinate salmonid restoration and enhancement efforts among various agencies and projects for the Umatilla, Walla Walla, John Day, Grande Ronde and Imnaha River Basins.

Education
Graduated 1979, Oregon State University
Bachelor of Science Degree in Fisheries

Craig R. Contor
Project Leader

Fisheries Related Employment
1993-1998, Project Leader, Umatilla and Walla Walla Basins Natural Production Monitoring and Evaluation Project. Confederated Tribes of the Umatilla Indian Reservation, Pendleton Oregon. Duties: coordinate and supervise fisheries monitoring efforts of the Tribal Fisheries Program; supervise two or three fisheries biologists and four to ten fisheries technicians; supervise surveys examining salmon and steelhead spawning, migration, habitat utilization, age, growth, survival, abundance and distribution; coordinate efforts with the Oregon Department of Fish and Wildlife research biologists; analyze data and write reports; hire, train and evaluate personnel; develop and track annual budgets; coordinate and account project purchases and expenditures; develop work plans; develop budgets and proposals, and finalize sampling procedures.

1992-1993, Fisheries Researcher, The Idaho Department of Fish and Game, Eagle, Idaho. Duties: evaluate hatchery steelhead smolt predation on wild chinook fry, in the upper Salmon River near Stanley, ID; supervised three to six technicians and bio-aids in field operations, data quality control, operation and maintenance of equipment, data transcription and analysis, and report writing; organize Idaho's anadromous hatcheries PIT tagging information; edited and sent the tagging; release and mortality files to PTAGIS in Portland, Oregon; assist in the training of technicians using a variety of software (Dbase, ProComm Plus, WordPerfect, Harvard Graphics, Kedit, DOS, and Systat (IBM PC compatible) for data entry, analysis and graphics, designed and assembled the wiring of an electrofishing system on a research boat.

1990-1991 Fisheries Project Biologist, Idaho Power, Department of Environmental Affairs, Boise, Idaho. Duties: project biologist on a cooperative IFIM study with the U.S. Fish and Wildlife Service; examined flows and habitat along 160 miles of the Snake River from C. J. Strike dam to Weiser, Idaho; electrofished at established index sites at night in the Snake River from Burley Idaho to Oxbow Reservoir; examined bass and crappie spawning behavior and habitat utilization in Brownlee Reservoir; sturgeon research included capturing, tagging and sonic tracking of sturgeon from Bliss Dam to C. J. Strike Dam; performed small surgeries to examine and sample gonads to determine sexual maturity of sturgeon; operated and maintained a variety of jet boats, trucks, nets, and other fisheries related equipment, and supervised one to four fisheries technicians.

1988-1990 Fisheries Technician (NTE), U. S. Forest Service, Intermountain Research Station, Boise, Idaho. Duties: supervised field crew of four biological technicians in collecting data for a livestock-fishery interaction studies and a stream carrying-capacity model and a classification study of streams in Idaho, Utah, and Nevada (physical and chemical habitat surveys and electrofishing); wrote several computer programs for modeling and analysis; tested and evaluated COWFISH a habitat/fish predictive model with field data; wrote reports, reviewed manuscripts, analyzed data, and prepared presentation and publication graphics.

1986-1988, Idaho State University, Research Assistant and Volunteer Teaching Assistant. Duties: planned, executed, evaluated and reported research on the rainbow trout populations and fishery of the Henry's Fork of the Snake River; wrote a computer model to examine trout populations in the Henry’s Fork; gathered baseline biological data (snorkeling and electrofishing); monitored and evaluated the winter day and night behavior and habitat utilization of juvenile rainbow trout; designed and conducted angler opinion and harvest survey; designed, organized and supervised the installation and evaluation of a large habitat improvement project to increase winter rearing habitat in the Harriman East section of the Henry's Fork; supervised 1 to 30 volunteers and one technician; designed and assembled the ISU electrofishing drift boat which included; wiring of 240, 120, 12 volt and variable voltage circuits, modifying the bow of the boat for more safe and ergonomic conditions, fabricating anodes and cathodes; assisted in the construction and maintenance of a solar powered riparian fence, and taught Biology 120 Lab, Man and his Environment at ISU.

1984-1985, Bio-Aid, Idaho Cooperative Fish and Wildlife Research Unit, Moscow, Idaho. 1985 Duties: supervised a research team in surveying salmonid stream habitat and estimating salmonid densities using snorkel techniques (calibrated with electrofishing estimates) in central Idaho streams; remodeled the fisheries warehouse, and organized research equipment. 1984 Duties: maintained hatchery brood stock at Hayden Creek Research Station, Lemhi Idaho; worked alone at the site for most of the summer; artificially spawned research brood stock, treated and picked eggs, and reared fry; kept mortality, tagging, spawning, temperature and feeding records; tagged fish; maintained grounds and equipment; assisted in the completion of a research stream channel; operated adult chinook trap: assisted in the capture and loading of adult chinook and research brood stock for transportation; maintained morpholine titration for adult attraction study, and conducted tours for visitors.

Publications and Project Reports

Senior author of all Umatilla Basin Natural Production Monitoring and Evaluation Project Annual Reports, 1992-93 through 1998. (see references list in section 7.g of this document)

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Donahue, Kieren E., Craig R. Contor, and John S. Griffith. 1991. Distribution and Abundance of Stoneflys (*Pteronarcys califonica*) in the Henry's Fork of the Snake River, Idaho. Idaho State University.

Contor, Craig R., Rodger L. Nelson, Warren P. Clary. 1989. Livestock-Fishery Interaction Studies: Tabor Creek, Chimney Creek, Deer Creek, and Cottonwood Creek; Project Completion Report, USDA Forest Service, Intermountain Research Station, Boise, Idaho. 20 p.

Contor, Craig R. 1989. Diurnal and Nocturnal Habitat Utilization of Juvenile Rainbow Trout in the Henry's Fork of the Snake River, Idaho. Masters Thesis, Department of Biological Sciences, Idaho State University. 70 p.

Contor, Craig R., William S. Platts. 1990. Assessment of COWFISH in Estimating Trout Abundance in Several Streams in Idaho, Nevada and Utah. USDA, Forest Service Research Paper. Intermountain Research Station, Boise, Idaho.

Angradi, Ted, Craig R. Contor. 1989. Henry's Fork Fisheries Investigations. University of Idaho, Idaho Fish and Game and the Henry's Fork Foundation, Job Completion Report for 1986-87, Project No. F-71-R-11, Subproject III, Jobs 7a and 7b.

Contor, Craig R. 1988. Modeling the Henry's Fork of the Snake River's rainbow trout with a variable input model. Idaho State University, Pocatello, Idaho.

Contor, Craig R. 1988. Fisheries Investigations of Blue Springs Creek, Thurman Creek, Fish Pond, and Fish Creek. Idaho State University, Pocatello, Idaho.

Presentations.

Contor C. R. 1998. Umatilla Basin Juvenile Salmonid Life Histories. Umatilla Basin Restoration Project Review. Pendleton Oregon.

Contor C. R. 1996. Umatilla Basin Natural Production Monitoring and Evaluation Project - Current Program and Significant Findings: CBFWA and BPA Project Review Meetings.

Contor C. R. 1993. Overview of the Umatilla Basin Natural Production Monitoring and Evaluation Project. OSU, Corvallis Oregon.

Contor, C. R. 1992. Hatchery Steelhead Smolt Predation of Wild and Natural Juvenile Chinook Salmon Fry in the Upper Salmon River, Idaho. Presented at the Lower Snake River Fish and Wildlife Compensation Plan meeting in Troy, Oregon.

Contor, C. R., M. D. Riehle and J. S. Griffith. 1988. Winter Ecology of Resident Juvenile Rainbow Trout in Two Idaho Streams. Formal Scientific Presentation presented at the Pacific Northwest Chapter of the American Fisheries Society Meeting 1988, Hood Canal, Washington.

Contor, C. R. 1988. Day and Night Winter Habitat Utilization of Juvenile Rainbow Trout in the Henry's Fork of the Snake River. Formal scientific presentation, presented at the Idaho Chapter of the American Fisheries Societies annual meeting, 1988. Boise, Idaho.

Contor, C. R. 1988. Summary of Idaho State University and the Henry's Fork Foundation Research and Activities from 1986-88 on the Henry's Fork of the Snake River.

Contor, C. R. 1988. Summary of the Idaho State Universities Winter Research on the Henry's Fork of the Snake River. Harriman State Park, Idaho.

Contor, C. R. 1987. Influences of Controlled Flow Releases on the Winter Survival and Habitat Utilization of Juvenile Rainbow Trout in the Box Canyon, Last Chance, and Harriman Ranch Reaches of the Henry's Fork River, Idaho. A formal presentation presented to Idaho Fish and Game in Idaho Falls, Idaho, and to the Bureau of Reclamation in Burley, Idaho.

Contor, C. R.1986. Microhabitat Utilization of Juvenile Trout in the Henry's Fork of the Snake River, Idaho. Department of Biological Sciences, Idaho State University, Pocatello, Idaho

Contor, C. R. 1984. The Construction, Operation, and Maintenance of a Morpholine Titration unit for the Olfactory Attraction of Adult Chinook Salmon Exposed as Juveniles.

Education

1986-1988. Idaho State University, Pocatello, Idaho. Graduated with a Master of Science degree in Biology (Fish Ecology) in May of 1989. Thesis; The Winter Day and Night Behavior and Habitat Utilization of Juvenile Rainbow Trout in the Henry's Fork of the Snake River. GPA 3.89 (4.0 Scale).

1983-1986. University of Idaho, Moscow, Idaho. Graduated with a Bachelor of Science degree in Fishery Resource Management (Ecology and Management of Resident and Anadromous Salmonids), Cum Laude, May 1986, GPA 3.48 (4.0 Scale).

1981-1983. Peninsula College, Port Angeles, Washington. Transferred to the University of Idaho with credits in general science, math, and writing. GPA 3.77 (4.0 Scale).

Certificates of Training
Regular CPR and First Aid Training 1988-1998
Open Water SCUBA Diving Certificate, 1991
Open Water SCUBA Rescue Diver Training, 1991
IFIM training (Instream Flow Incremental Methodology) IFIM 200, 201 and 310.

Awards
1989, Certificate of Merit, Awarded for Superior Performance in the Evaluation of the COWFISH Model, USFS, Intermountain Research Station, Including a $400 Cash Award

1989, Special Award for Outstanding Research and Conservation Efforts, from the Henry's Fork Foundation, Dr. M. R. Mickelson, Pocatello, Idaho, 208-234-1960.

1985, Outstanding Senior, Fishery Resources, College of Forestry, Wildlife and Range Sciences, University of Idaho, Moscow, Idaho 83843.

Paul Kissner
Senior Biologist

Employment
10/1992 – Present. Senior Fisheries Biologist (1.0 FTE). Confederated Tribes of the Umatilla Indian Reservation. Duties: responsible for monitoring escapement and spawning of adult salmonids above Three Mile Falls Dam in the Umatilla River; supervise 1-5 fisheries technicians; monitor spawning success; estimate egg deposition, collect biological data on spring and fall chinook and coho salmon and summer steelhead; read scales; digitize and summarize data, and write annual reports.

1988-1990. Temporary Fishery Research Biologist. Alaska Department of Fish and Game. Duties: trained various fishery biologists in aerial survey techniques to enumerate the chinook escapement in southeast Alaska; conducted field studies, and wrote completion reports.

1971-1987. Chinook Salmon Research Project Leader. Alaska Department of Fish and Game. The major objective was to determine the status of southeast Alaska wild chinook salmon stocks. This was accomplished by development of methods to determine the origin of chinook salmon harvested in mixed stock ocean fisheries (scale pattern analysis and coded wire tagging) and enumeration of spawners in major basins. Duties: developed project objectives, managed an annual budget of $150,000 -$300,000; analyzed data collected, prepared annual reports, hired and evaluated 1-10 seasonal employees and an assistant project leader; explained data findings and presented results at various user group meetings and at the Board of Fisheries annual meeting; Member of the Chinook Salmon Technical Committee that dealt with a broad gamut of chinook salmon issues in southeast Alaska, and a member of the Transboundary River Treaty associated with the U.S. Canada Salmon Treaty. Retired from the Alaska Department of Fish and Game on September 30, 1987.

1969-1971. Assistant Project Leader. Alaska Department of Fish and Game. Cook Inlet Sockeye Salmon Research Project. Duties: enumerate adult sockeye in Cook Inlet and conduct studies to separate mixed stocks; supervised up to 10 fishery technicians, and assisted in data analysis, preparing reports and developing annual budgets.

1967-1969. Crew Leader. Alaska Department of Fish and Game.
Duties: supervise crew on dolly varden charr life history project.

Publications
Co-author of five Umatilla Basin Natural Production Monitoring and Evaluation Project reports 1992-93 through 1996-97 (see references listed in section 7.g. of this document).

Mecum, R. D. and P. D. Kissner, Jr. 1989. A study of chinook salmon in southeast Alaska. Alaska Department of Fish and Game, Division of Sport Fish, Data Series 117, Juneau Alaska.

Kissner, Paul D. 1985. A study of chinook salmon in southeast Alaska. Alaska Department of Fish and Game. Annual Report 1984-1985. Project f-9-17, 26 (AFS-41).

Education
Graduated 1968, Colorado State University
Bachelors of Science Degree in Fisheries Biology

Additional Training
Sea Survival 1984
Law Enforcement 1979
Measuring Job Performance 1978
Basic Law Enforcement Training 1977

Eric Hoverson
Field Biologist

Employment
11/1992 – Present. Field Biologist (1.0 FTE). Confederated Tribes of the Umatilla Indian Reservation. Duties: inventory and monitor habitat. Electrofish streams and estimate salmonid abundance and densities, estimate natural production capacity of juvenile salmonids in the Umatilla Basin, collect, digitize and summarize data, write annual reports.

3-10/1992. Fisheries Technician. United States Army Corps of Engineers. Individual operation of juvenile salmonid collection facility. Monitor fish condition and make adjustments to improve survival rates, assist juvenile transportation. Compile data into detailed reports.

10/1991-3/1992. Waterfowl Research Technician. North Carolina State University. Cooperative project with the U.S. Fish and Wildlife Service and the United States Marine Corps involving: species counts, behavioral observations, taking blood sample, harvest census, deploying and downloading dosimeter data, and maintaining field equipment.

5-10/1991. Riverway Technician. Wisconsin Department of Natural Resources. Duties: Provide assistance to wardens in enforcement of natural river system laws and public education, supervise youth crews. Constructed handicapped-access and wildlife observation sites. Removed dwellings. Maintained public facilities. Night watchman of state property.

9/1990-1/1991. Fisheries Technician. Wisconsin Department of Natural Resources. Duties: Population sampling by use of boomshocker, age determination/scale analysis, install trout habitat structures, gamefish and gamebird stocking, equipment operation and maintenance.

5-9/1990. Trout Habitat Technician. Wisconsin Department of Natural Resources. Duties: Construct and install instream habitat structures, supervise work crews, restore riparian vegetation, population surveys using backpack electroshockers, heavy equipment operation.

5-9/1989. Research Assistant. Wisconsin Department of Natural Resources. Population sampling with gillnets, net repair, radio telemetry, water quality testing, data entry and writing research reports.

Publications

Co-author of five Umatilla Basin Natural Production Monitoring and Evaluation Project, annual reports 1992-93, through 1996-1997 (see references listed in section 7.g. of this document)

Education

Graduated 1990, University of Wisconsin-Stevens Point
Bachelors of Science Degree in Biology, Fisheries Emphasis, Water Resource Minor

Treehaven natural resource field station. 1988
240 hours of Conservation/Management of Natural Resources,

Certification
Boating skill and seamanship (USCG)
First Aid/CPR (ARC)

Gene Shippentower
Lead Fisheries Technician

Employment
11/1997 – Present Lead Fisheries Technician (1.0 FTE). Confederated Tribes of the Umatilla Indian Reservation. Duties: supervising fisheries technicians in addition to duties outlined below with the previous position.

11/1990 – 11/1997. Fisheries Technician (1.0 FTE). Confederated Tribes of the Umatilla Indian Reservation. Duties: electrofish index sites annually to estimate trends in salmonid densities and abundance; electrofish large reaches to determine salmonid densities and abundance of subbasins; conduct habitat inventories throughout the Umatilla River Basin; operate rotary screw traps to capture outmigrating juvenile salmonids; record and enter trap data; prepare scales, read scales, and summarize scale data; freeze brand, mark and PIT tag juvenile chinook salmon for migration studies; monitor fish passage with radio telemetry equipment; load and transport adult and juvenile salmonids; install habitat enhancement structures; operate acclimation facilities; assist with the artificial spawning of summer steelhead, and spring and fall chinook salmon; seine natural juvenile fall chinook in the Hanford Reach of the Columbia River for coded wire tagging, and supervise seasonal technicians.

6-11/1990. Fish Technician I, Seasonal. Oregon Department of Fish and Wildlife, Lookingglass Fish Hatchery, Elgin OR. Duties: artificial production of spring chinook. Maintain raceways and water pumps; record daily feedings; collect and record mortalities daily; sample juvenile chinook salmon monthly for growth estimates; treat eggs, juveniles and adults with chemicals for disease control; assist with loading and transporting fish, and clip juvenile chinook salmon for coded wire tagging.

10/1989 – 6/1990. Fish Technician I, Seasonal. Oregon Department of Fish and Wildlife, Bonneville Fish Hatchery, Cascade Locks, OR. Duties: maintain fish raceways; record daily feedings; collect and record moralities daily, and sample juvenile chinook and coho salmon monthly for growth estimates.

Education
Graduated 1990, Mount Hood Community College, Gresham, OR
Associate of Arts Degree in Fisheries Science

Darryl J. Thompson

Fisheries Technician

Employment

1994-Present Fisheries Technician (1.0 FTE). Confederated Tribes of the Umatilla Indian Reservation. Duties: operate rotary screw traps; survey habitat; electrofish; PIT tag; survey spawning grounds, and monitor tribal harvest.

6/1993-1994 Seasonal Fisheries Technician. Confederated Tribes of the Umatilla Indian Reservation. Duties: assisted biologists seasonally with traps, habitat surveys and electrofishing.

2/1993 – 6/1993 Heavy Equipment Operator. Tomco Construction, Mission Highway Project. Duties: operated heavy equipment for pipe installation for Indian contractor; operated an excavator, compactor, backhoe, and front-end loader.

4-9/1992. Heavy Equipment Operator. Kiewit Pacific Construction Co. I-84 re-surface project. Duties: operated heavy equipment including a grader, paver, roller, front-end loader, and backhoe.

9-10/1990. Laborer/Operator. Weaver Construction, Umatilla River/BPA project. Constructed fish ladder and fish acclimation sites. Duties: general construction work; cement work; build forms, landscape, and move earth; operated backhoe and front-end loader.

Certificate

Certificate of Completion, 1980, West Coast Training Facility, Gresham OR
Heavy Equipment Operator

James R. Marsh
Fisheries Technician

Employment

1996 – Present. (Fisheries Technician 1.0 FTE). Confederated Tribes of the Umatilla Indian Reservation, Pendleton, Oregon. Duties: assist biologists with rotary screw trapping, electrofishing and spawning surveys.

1992-1996. Seasonal Fisheries Technician. Confederated Tribes of the Umatilla Indian Reservation, Pendleton, Oregon. Duties: assist biologists seasonally with electrofishing, trapping and night watchman at facilities.

1992 June-September. Seasonal Fisheries Technician. National Marine Fisheries Service. Duties: assisted researchers seasonally with the collection of water samples, zooplankton samples, turbidity samples and boat operation.

1992 May-September. Seasonal Forestry Technician. Bureau of Indian Affairs.
Duties: thinned trees seasonally on the Umatilla Indian Reservation

Expertise Description
I have over 25 years of experience with the salmon and steelhead on the Columbia and Umatilla Rivers. I have seen runs decline over these years. The only river I see making any progress is the upper Umatilla River. As you know, we have walked every creek and stream in this basin. We have taken lots of scales, and done lots of measuring over the last five and a half years. We have also seen what kind of impact wheat farmers and cattle ranchers can do to the streams and creeks in this area. I feel I have the expertise to make that judgement call.

Qualifications for Duties
All the work we have done in the Umatilla River has not been a waste of your money. As you know, we have electrofished every stream and creek within the Umatilla Indian Reservation. We have also walked up creeks without names, and we still found rainbow trout in these dry creek beds where no one would think that there were fish. I also feel that it takes a certain type of person to be in the field because of the harsh climate conditions as a field biologist and a field technician.

Section 10. Information/technology transfer

This monitoring and evaluation project produces information in the form of formal reports. The information is used by managers and researches to adaptively manage local steelhead and salmon stocks, however our information has application to salmonid restoration efforts throughout the Columbia River Basin. Technology transfer is also facilitated by monthly oversight committee meetings, annual basin operation meetings, and formal presentations at various conferences and forums.